

REMARKS

At the time the current Official Action was mailed, the Examiner rejected claims 21-34 and objected to claims 11-16. Applicants thank the Examiner for the recognition of allowable subject matter in the present claims. However, for at least the reasons set forth below, Appellants respectfully submit that all of the pending claims are allowable in their present form. In view of the following remarks, Applicants respectfully request reconsideration and allowance of all pending claims.

Claim Rejections under 35 U.S.C. § 103(a)

The Examiner rejected claims 21-29 and 31-34 under 35 U.S.C. § 103(a) as unpatentable over Miremadi et al. (U.S. Patent No. 5,854,507, hereinafter “Miremadi”). Additionally, the Examiner rejected claim 30 under 35 U.S.C. § 103(a) as unpatentable over Miremadi in view of Huang et al. (U.S. Patent No. 5,854,507, hereinafter “Huang”). Applicants respectfully traverse these rejections.

Legal Precedent

The burden of establishing a *prima facie* case of obviousness falls on the Examiner. *Ex parte Wolters and Kuypers*, 214 U.S.P.Q. 735 (B.P.A.I. 1979). To establish a *prima facie* case, the Examiner must not only show that the combination includes *all* of the claimed elements, but also a convincing line of reason as to why one of ordinary skill in the art would have found the claimed invention to have been obvious in light of the teachings of the references. *Ex parte Clapp*, 227 U.S.P.Q. 972 (B.P.A.I. 1985). In establishing a *prima facie* case for obviousness, “the scope and content of the prior art are to be determined; differences between the prior art and the claims at issue are to be ascertained; and the level of ordinary skill in the pertinent art resolved. Against this background the obviousness or nonobviousness of the subject matter is determined.” *KSR Int’l Co. v. Teleflex, Inc.*, 127 S. Ct. 1727 at 1729 (2007).

Furthermore, the *KSR* court did not diminish the requirement for objective evidence of obviousness. *Id.* at 1730 (“To facilitate review, this analysis should be made explicit. See *In re*

Kahn, 441 F.3d 977, 988 (CA Fed. 2006) (“[R]ejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness”). As our precedents make clear, however, the analysis need not seek out precise teachings directed to the specific subject matter of the challenged claim, for a court can take account of the inferences and creative steps that a person of ordinary skill in the art would employ.”); *see also, In re Lee*, 61 U.S.P.Q.2d 1430, 1436 (Fed. Cir. 2002) (holding that the factual inquiry whether to combine references must be thorough and searching, and that it must be based on *objective evidence of record*).

When prior art references require a selected combination to render obvious a subsequent invention, there must be some reason for the combination other than the hindsight gained from the invention itself, i.e., something in the prior art as a whole must suggest the desirability, and thus the obviousness, of making the combination. *Uniroyal Inc. v. Rudkin-Wiley Corp.*, 837 F.2d 1044, 5 U.S.P.Q.2d 1434 (Fed. Cir. 1988). One cannot use hindsight reconstruction to pick and choose among isolated disclosures in the prior art to deprecate the claimed invention. *In re Fine*, 837 F.2d 1071, 5 U.S.P.Q.2d 1596 (Fed. Cir. 1988). The Federal Circuit has warned that the Examiner must not, “fall victim to the insidious effect of a hindsight syndrome wherein that which only the inventor taught is used against its teacher.” *In re Dembiczak*, F.3d 994, 999, 50 U.S.P.Q.2d 52 (Fed. Cir. 1999) (quoting *W.L. Gore & Assoc., Inc. v. Garlock, Inc.*, 721 F.2d 1540, 1553, 220 U.S.P.Q. 303, 313 (Fed. Cir. 1983)).

Deficiencies of the Rejection of Claim 21

Applicants assert that Miremadi does not disclose “forming a die stack before placing the die stack on a temporary holding surface, wherein the die stack comprises an adhesive on at least one surface of a first die, wherein forming the die stack comprises mechanically coupling the die stack together via the adhesive,” as recited by independent claim 21. Further Applicants assert that Miremadi does not disclose “picking the die stack from the temporary holding surface; and placing the die stack on a substrate,” as also recited by claim 21.

Miremadi does not disclose any “temporary holding surface.” Indeed, all of the figures of Miremadi illustrate one or more chips coupled to a substrate. *See e.g.*, FIG. 3 and substrate 15; FIG. 8 and substrates 51 and 57. The Examiner admits that Miremadi does not disclose “moving said die stack to a temporary position prior to moving it to substrate.” Final Office Action, page 2. While Applicants agree with the Examiner’s assertion, Applicants note that claim 21 does not recite a “temporary position” but instead recites a “temporary holding surface.” Further, as stated below, Applicants disagree with the Examiner’s assertion that use of a “temporary holding surface” is obvious to one of ordinary skill in the art.

In rejecting claim 21, the Examiner also stated that “it would have been obvious to one of ordinary skill in the art to place the completed die stack upon a temporary holding surface because the placing of the die stack on the temporary surface merely adds complexity to the process of Miremadi.” Final Office Action, page 2. Further, the Examiner stated that “[t]he process of Miremadi would have been expected by one of ordinary skill in the art to be performed equally well by taking different paths for the stack because the stack is ultimately placed in the desired position in all such processes and the intermediate placing on a temporary surface would not be expected to materially alter the final positioning.” *Id.* at pages 2-3.

Applicants assert that the Examiner’s obviousness conclusion is not supported by any objective evidence other than that gained by hindsight gained from the Applicants’ application. Further, “the mere statement that the claimed invention is within the capabilities of one of ordinary skill in the art is not sufficient by itself to establish *prima facie* obviousness.” M.P.E.P. § 2143.01 (IV). For example, Applicants assert that the Examiner’s argument that the addition of a temporary holding surface “merely adds complexity to the process of Miremadi” has no objective evidence for support. To the contrary, as stated in the specification of the present application, the forming the die stack results in “reducing the number of iterations as compared to the typical method of forming die stacks *directly on the substrate*”(i.e., without the use of a temporary surface). Application, page 13. Emphasis added. Further, “the stack can be

assembled using a first adhesive and cured at a different temperature than the adhesive used to attach the die to a substrate.” *Id.*

Additionally, Applicants disagree with the Examiner’s assertion that the use of temporary holding surface would not “materially alter the final positioning.” Final Office Action, page 3. In contrast, as stated in the specification, “curing a stacked die package which includes a substrate may create stress damage due to the coefficient of thermal expansion (CTE) mismatch between the die and substrate.” Application, page 4. Further, the number of iterations may “result in damage to one or more die of the stack.” *Id.* Thus, based on these reasons, the Examiner’s statement that addition of a temporary holding surface “merely adds complexity” or is obvious to one having ordinary skill in the art is not based on any objective evidence of obviousness, but is a conclusory statement set forth to disclose those features of claim 21 for which the Examiner cannot find a prior art reference.

Finally, Applicants assert that Miremadi teaches away from the use of temporary holding surface. The process described in Miremadi clearly describes electrically coupling the chips together *after* placing the chips on a substrate. As stated in Miremadi:

Interconnection between layers will be explained with reference to FIGS. 7-9. While FIGS. 7 and 8 in particular show only two IC layers, it should be understood that the preferred attachment process between IC layers and between, a between an IC layer or finished assembly and the PCB, are identical; consequently, attachment of any two IC layers could, in the context of the present invention, be taken to either be IC layers (designated by reference numeral 13 in FIGS. 1-3), or a single substrate 15 of a "bottom" IC layer and the PCB 17. **However, it will be assumed for purposes of the discussion below that two substrates that are to be connected represent two IC layer substrates already having chips mounted upon them.**

FIG. 7 shows a first substrate 51 and a second substrate 57 which are connected together by solder balls 19. In accordance with the principles described above for forming each IC layer, solder balls are mounted on substrates 51 and 57 laterally adjacent to an IC 63 or 65. **In forming connection between layers, the solder balls 19**

are preferably pre-deposited on the top side 59 of each substrate. The substrates, solder balls and associated pads are aligned, and then are heated to a temperature sufficient to melt the solder balls and bring the substrates (and associated heat conducting layers 40) into direct contact with underlying ICs.

Miremadi, col. 7, lines 25 -35 (Emphasis added).

As illustrated in Fig. 7 of Miremadi, the chips are disposed on the substrates 51 and 57 *before and during* the process of electrically coupling the chips together. Miremadi, Fig. 7; col. 7, lines 25-35. Thus, Miremadi teaches electrically coupling the chip stack together *after* placing the chip on a substrate. This technique teaches away from “electrically coupling the die stack together...[and] ... picking from the temporary holding surface, and placing the die stack on a substrate” as recited by claim 21.

For at least these reasons, Applicants respectfully request withdrawal of the rejection of claim 21 under § 103 and allowance of claim 21 and claims 22-34 that depend therefrom.

Deficiencies of the Rejection of Claim 22

While Applicants believe that claim 22 is allowable based on its dependency on claim 21, Applicants would like to point to additional features of claim 22 that are allowable over the cited reference. For example, claim 22 recites, *inter alia*, “the act of curing the die stack before the act of picking the die stack.”

The Examiner stated that “fig. 8 shows the stack prior to being placed on a substrate, therefore it was cured prior to being picked from the temporary surface.” Final Office Action, page 3. Applicants respectfully disagree. As stated in Miremadi, Fig. 8 includes substrates 51 and 57. Miremadi, col.8, lines 1-19. Thus, IC’s 63 and 65 are already placed on substrates 51 and 57 before curing. Indeed, in describing Fig. 8, Miremadi states: “heating of the assembly and tendency of the solder balls 19 to spread to adhere to associated bonding pads 31 causes the

solder balls to become molten and deform, to draw the substrates together to sandwich ICs between them.” *Id.* at col. 7, lines 36-44. Thus, Miremadi does not show the chip stack cured prior to being placed on a substrate or “before the act of picking the die stack,” as recited by claim 22. Accordingly, Applicants respectfully request withdrawal of the rejection and allowance of claim 22.

Deficiencies of the Rejection of Claim 23

While Applicants believe that claim 23 is allowable based on the dependency on claim 21, Applicants would also like to point to additional features of claim 23 that are allowable over the cited reference. Applicants assert that Miremadi does not disclose “comprising the act of testing the die stack before the act of picking the die stack,” as recited by claim 23.

In the Examiner’s rejection, the Examiner stated that “the background of Miremadi teaches it is well known to test a chip prior to being mounted on a PCB.” Final Office Action, page 3. In contrast, Miremadi actually discloses mounting the chip on a substrate, e.g., a carrier, then testing the chip, then mounting the chip and the carrier to a PCB. As stated in Miremadi, “[c]onventionally, the silicon chips are mounted to a carrier, the use of which facilitates testing of the chip prior to mounting to a printed circuit board (“PCB”).” Miremadi, col. 1, lines 23-25. Applicants assert that mounting to a carrier, as disclosed in Miremadi, is analogous to mounting to a substrate. Thus, according to the testing disclosed in Miremadi, the chip is already mounted to a substrate, and then tested, before mounting to the PCB. Accordingly, Miremadi does not disclose “testing the die stack before the act of picking the die stack,” as recited by claim 23, and Applicants respectfully request withdrawal of the rejection and allowance of claim 23.

Deficiencies of the Rejection of Claim 31

Additionally, while Applicants believe that claim 31 is allowable based on the dependency on claim 21, Applicants would like to point to additional features of claim 31 that are allowable over the cited reference. Applicants assert that Miremadi does not disclose “applying the adhesive between each die in the die stack, the adhesive being curable at a first

temperature ... applying a second adhesive between the die stack and the substrate, the second adhesive being curable at a second temperature lower than the first temperature,” as recited by claim 31.

In rejecting claim 31, the Examiner stated that “the adhesive being curable at a first temperature [fig. 8, 38 the first adhesive is used as a thermal conductor, therefore it must have a very high temperature].” Final Office Action, page 6. Further, the Examiner stated “[a]pplying the second adhesive between the die stack and the substrate, the second adhesive being curable at a temperature lower than the first temperature [fig. 9, 67 (19 in fig. 8) column 8, lines 20-35, the solder is reflowed while the layer 38 still acts as a heat transport layer].” *Id.* Applicants note that element 38 referred to in the Examiner’s rejection is disclosed in Miremadi as “first layer, 38...formed from a heat conductor, such as an adhesive conductor tape.” Miremadi, col. 5, lines 5-7. As best as Applicants can determine, the Examiner is applying the “solder balls 67” as an adhesive. Solder balls are not an adhesive as disclosed in either Miremadi or in Applicants’ application. Further, the Examiner’s characterization of solder balls as an adhesive is contrary to the Examiner’s previous statement that the adhesive is element 38, i.e., “adhesive conductive tape.” Thus, Miremadi does not disclose “applying the adhesive between each die in the die stack, the adhesive being curable at a first temperature ... applying a second adhesive between the die stack and the substrate, the second adhesive being curable at a second temperature lower than the first temperature” as recited by claim 31. Accordingly, Applicants respectfully request withdrawal of the rejection and allowance of claim 31.

Deficiencies of the Rejection of Claim 30

Claim 30 is dependent on claim 21. As discussed above, Miremadi does not obviate claim 21. Huang does nothing to cure the deficiencies of the Miremadi discussed above with regard to claim 21. Thus, the cited combination does not disclose or suggest all of the elements of the claimed invention, and thus, cannot possibly render the claimed subject matter obvious. Accordingly, Applicants respectfully request withdrawal of the Examiner’s rejection and allowance of claim 30.

Allowable Subject Matter

In the Office Action, the Examiner objected to claims 11-16 as being dependent upon a rejected base claim, but stated that these claims would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. Final Office Action, page 7. Applicants thank the Examiner for indicating the potential allowability of claims 11-16. At this time, however, Applicants believe that all of the pending claims are allowable and have thus chosen not to rewrite claims 11-16 in independent form.

Conclusion

In view of the remarks set forth above, Applicants respectfully request reconsideration of the Examiner's rejections and allowance of all pending claims. If the Examiner believes that a telephonic interview will help speed this application toward issuance, the Examiner is invited to contact the undersigned at the telephone number listed below.

Respectfully submitted,

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